

**FACTORS ASSOCIATED WITH SUSTAINED VIROLOGIC  
RESPONSE TO HEPATITIS C TREATMENT IN A HOMELESS-  
EXPERIENCED COHORT IN BOSTON, 2014-2020**

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Evidence & Evaluation

30-minute presentation

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NATIONAL  
HEALTH CARE  
*for the*  
HOMELESS  
COUNCIL



## DISCLOSURES

- No conflicts of interest to disclose
- Acknowledgements
  - Team members & collaborators: Maggie Beiser, Khadija Muse, Giavanna Wilson, Travis Baggett
  - BHCHP Research Institute
  - HCV team clients

# OVERVIEW

1. Learning objectives
2. Background on HCV
3. BHCHP & HCV treatment team
4. Research
  - a) Overview
  - b) Background
  - c) Methods
  - d) Results
  - e) Summary
5. Discussion
  - a) Housing, substance use & cure
  - b) Ideas for quality improvement
  - c) Conclusion & further discussion

## LEARNING OBJECTIVES

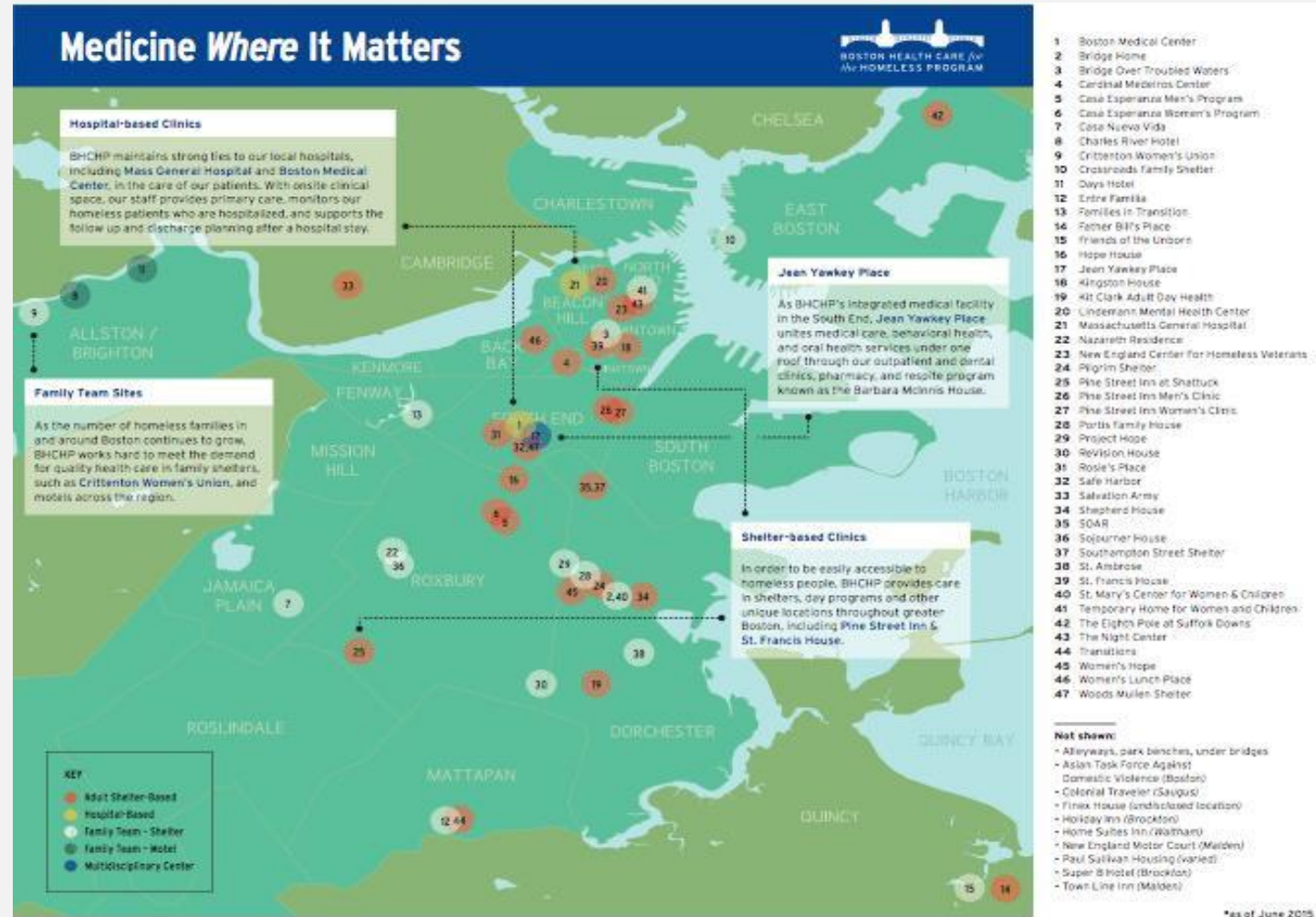
1. Describe cure rates for individuals experiencing homelessness and unstable housing receiving hepatitis C treatment in a homeless health center-based program in Boston.
2. Understand how housing status and recent substance use are associated with the likelihood of achieving cure.
3. Brainstorm ideas for quality improvement initiatives to improve cure rates across both broader cohorts and unique subpopulations.

## BACKGROUND

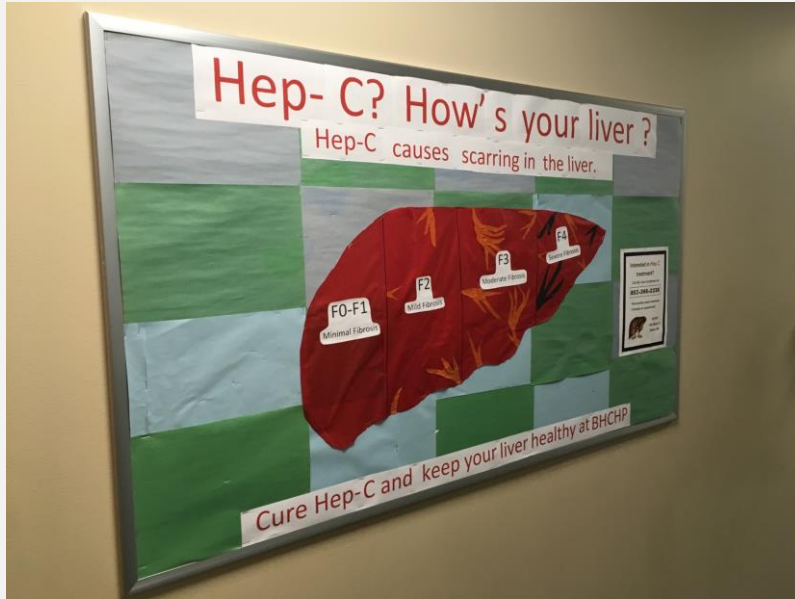
- HCV prevalence is ~1% in the general, housed population
  - 12-31% among those experiencing homelessness or unstable housing
  - As high as 70-78% for homeless PWID
- WHO goal of HCV elimination by 2030
- American Association for the Study of Liver Diseases (AASLD) has recognized the need for innovative approaches for supporting people who are homeless, unstably housed, or who inject drugs
- Homelessness and unstable housing have been associated with a lower likelihood of HCV treatment initiation and completion
  - If an individual is retained through treatment, studies have shown comparable cure rates compared to housed populations

# BOSTON HEALTH CARE FOR THE HOMELESS PROGRAM

- Founded 1985
- Serves 11,000 patients per year



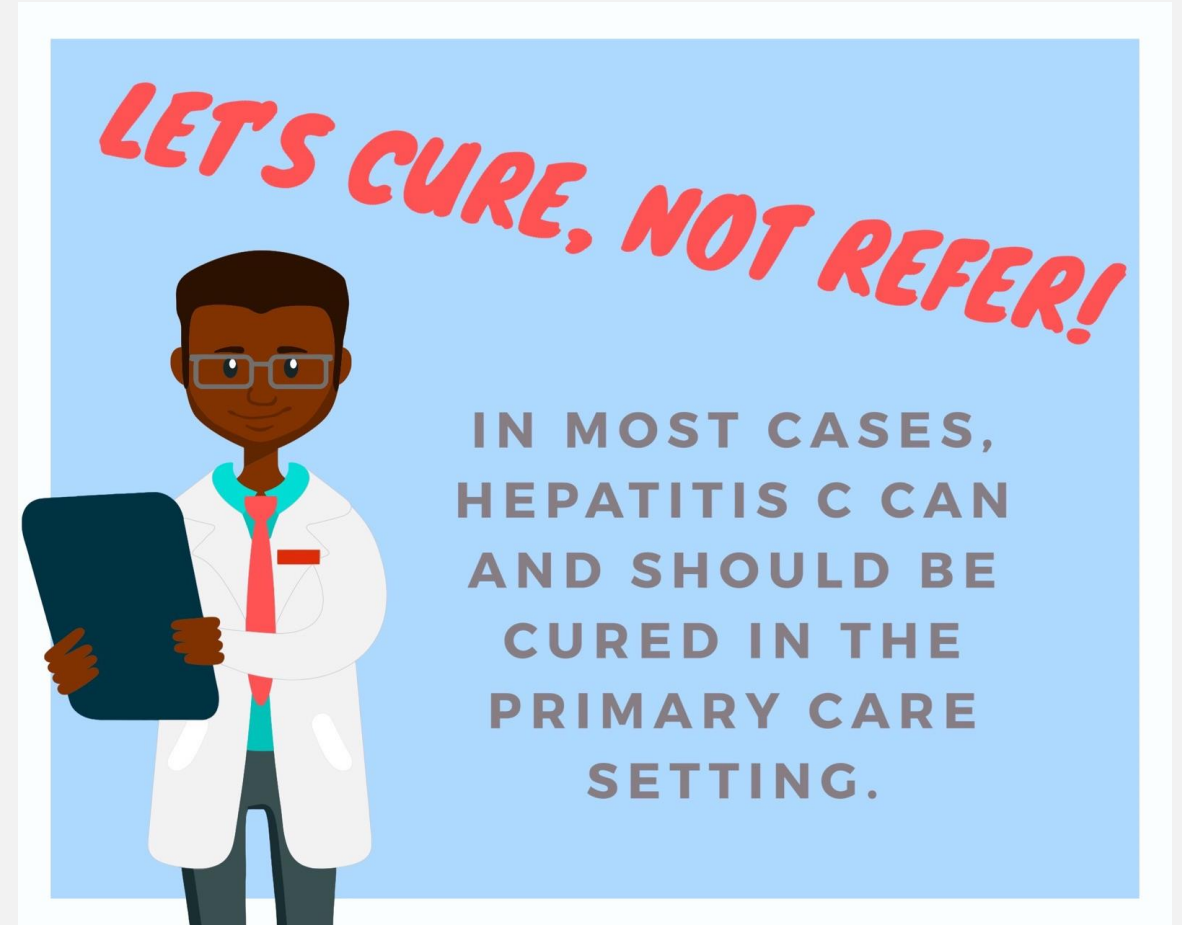
## BHCHP HCV TEAM



- Team founded in 2014
  - Advent of DAA therapy
  - 23% prevalence HCV (2013)
    - Excess morbidity and cost
  - Needs assessment revealed 74% had interest and confidence they could complete treatment (2017)
- Structure
  - Care coordinators, nursing, data manager, program director
  - Non-specialist PCPs
- Funding
  - Directly billable services to (majority) Medicaid, Medicare, private payers
  - DPH and internal support for nonbillable services

## EMPHASIS ON CARE COORDINATION

- Two full time care coordinators
  - Referral management
  - PA completion and navigation
  - Specialty pharmacy coordination
  - Patient education
  - Flexible adherence support
  - Appointment escorting
  - Cohort management/tracking





## PREVIOUS RESEARCH

- Beiser M, Leon C, Gaeta JM. Needs Assessment of HCV-Infected Individuals Experiencing Homelessness and Implications. *J Health Care Poor Underserved*. 2017.
- Barocas JA, Beiser M, León C, Gaeta JM, O'Connell JJ, Linas BP. Experience and Outcomes of Hepatitis C Treatment in a Cohort of Homeless and Marginally Housed Adults. *JAMA Intern Med. Research Letter*. 2017.
- Beiser ME, Smith K, Ingemi M, Mulligan E, Baggett TP. Hepatitis C treatment outcomes among homeless-experienced individuals at a community health centre in Boston. *Int J Drug Policy*. 2019.
- Beiser ME, Cardoso L, Gaeta JM, Baggett TP. Estimating the Prevalence of Advanced Fibrosis in Homeless Adults with Hepatitis C in Boston. *J Health Care Poor Underserved*. 2020;31(1):128-139. doi:10.1353/hpu.2020.0013
- Current manuscript under review

### Research Letter

June 2017

FREE

## Experience and Outcomes of Hepatitis C Treatment in a Cohort of Homeless and Marginally Housed Adults

Joshua A. Barocas, MD<sup>1,2</sup>; Marguerite Beiser, NP<sup>3</sup>; Casey León, MPH<sup>3</sup>; et al

[» Author Affiliations](#) | [Article Information](#)

*JAMA Intern Med*. 2017;177(6):880-882. doi:10.1001/jamainternmed.2017.0358

### Estimating the Prevalence of Advanced Fibrosis in Homeless Adults with Hepatitis C in Boston

Marguerite E Beiser, ANP-BC  
Lena Cardoso, BA  
Jessie M Gaeta, MD  
Travis P Baggett, MD, MPH



International Journal of Drug Policy

Volume 72, October 2019, Pages 129-137



## Hepatitis C treatment outcomes among homeless-experienced individuals at a community health centre in Boston

Marguerite E. Beiser <sup>a</sup>  , Kamala Smith <sup>a</sup> , Molly Ingemi <sup>a</sup> , Emma Mulligan <sup>a</sup> , Travis P. Baggett <sup>a, b, c</sup> 

# RESEARCH

Factors associated with sustained virologic response to hepatitis C treatment in a homeless-experienced cohort in Boston, 2014-2020.

Under review in the Journal of General Internal Medicine

Marguerite E. Beiser, Leah C. Shaw, Giavanna A. Wilson, Khadija O. Muse, Savanna K. Shores, Travis P. Baggett

# OUTCOMES

- Primary outcome:
  - SVR, defined as an HCV RNA not detected at least 12 weeks after treatment completion.
- Secondary outcome
  - Process-oriented outcomes included retention at key steps in the treatment cascade: completion of treatment, assessment for SVR, and achievement of SVR.

**SVR = Cure**

## METHODS

- Retrospective cohort study of all individuals who initiated HCV treatment at BHCHP between January 2014 and March 2020
  - Information collected at time of HCV intake (generally a visit with team nurse)
- Data extracted from EHR and HCV team's internal tracking system (Salesforce)
  - Demographics: age, race, ethnicity, gender identity, housing status
  - Associated clinical factors: Presence of HIV or opioid use disorder diagnoses
  - HCV-specific clinical information: referral source, risk factor for HCV acquisition, fibrosis status, RNA level, genotype, treatment duration, regimen choice
  - Self-reported data: recent substance use (heavy alcohol use or illicit substance use), past year incarceration history

# DATA ANALYSIS

- Baseline demographics
- Primary outcome:
  - The proportion of individuals achieving SVR was calculated using the intention to treat (ITT) principle where all participants who started treatment were included in the denominator, with anyone lost to follow-up considered not to have achieved SVR
  - In a sensitivity analysis, we re-estimated the proportion who achieved SVR using a modified ITT (mITT) approach where participants who were not assessed for SVR were excluded from the denominator
- Secondary outcomes:
  - Calculated proportion of patients who completed tx, proportion who returned for SVR assessment, and the proportion who achieved SVR
- Conducted unadjusted analyses to determine associations between baseline variables and outcomes (t-test, chi-squares, fisher exact test)
- Logistic regression was used for adjusted analysis: variables were chosen based on unadjusted associations, *a priori* hypotheses, and previous research

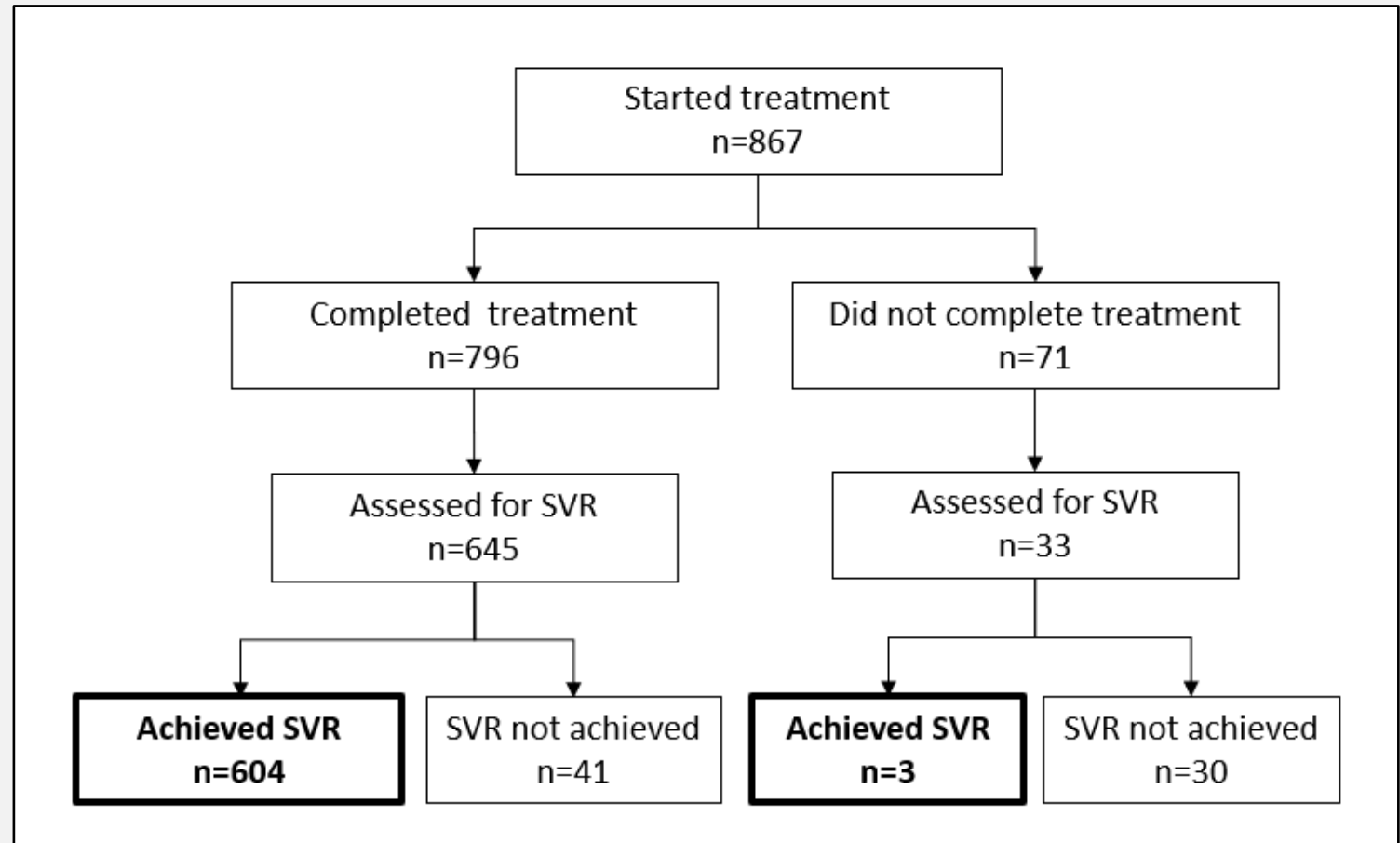
# BASELINE DEMOGRAPHICS

Characteristics of individuals who initiated HCV treatment at BHCHP between January 2014 and March 2020 (n=867).

Characteristic	N (%)
<b>Sociodemographic</b>	
Age < 45 years	411 (47.40)
Male gender identity	700 (80.74)
Race	
White	502 (57.90)
Black / African American	191 (22.03)
Other	19 (2.19)
Unknown	155 (17.88)
Ethnicity	
Hispanic	193 (22.26)
Non-Hispanic	608 (70.13)
Unknown	66 (7.61)
Primary language: English	777 (89.62)
Housing status	
Homeless or unstably housed	729 (84.08)
Stably housed	138 (15.92)
<b>Substance use and medical conditions</b>	
Documented heavy alcohol use, past 6 months	136 (15.69)
Documented illicit drug use, past 6 months	392 (45.21)
Opioid use disorder	
No	274 (31.60)
Yes, treated	442 (50.98)
Yes, untreated	151 (17.42)
HIV coinfection	93 (10.73)

<b>HCV characteristics</b>	
Referral source	
Internal	609 (70.24)
Counseling & Testing	208 (23.99)
External / self-referred	50 (5.77)
Injection drug use identified as risk factor for HCV acquisition	768 (88.58)
Fibrosis stage	
F0-F3 or indeterminant	741 (85.47)
F4	126 (14.53)

FLOW CHART: ALL BHCHP  
PATIENTS INITIATING  
HCV TREATMENT  
BETWEEN JANUARY 2014-  
MARCH 2020



**70.0% ITT SVR**  
**89.5% mITT SVR**

FACTORS  
ASSOCIATED  
WITH SVR IN  
MULTIVARIABLE  
ANALYSIS.

n=864

	Adjusted Odds Ratio (95% CI)
Age	
< 45 years	Ref
≥ 45 years	<b>1.53 (1.04 – 2.26)</b>
Housing status	
Homeless or unstably housed	Ref
Stably housed	<b>3.83 (1.85 – 7.90)</b>
Recent drug use, past 6 months	
No	Ref
Yes	<b>0.63 (0.41 – 0.95)</b>
Unknown	1.17 (0.62 – 2.21)
Heavy alcohol use, past 6 months	
No	Ref
Yes	<b>2.27 (1.40 – 4.00)</b>
Unknown	1.52 (0.94 – 2.43)
Referral source	
Internal	Ref
Counseling & Testing	<b>0.50 (0.34 – 0.75)</b>
External / self-referred	<b>0.27 (0.14 – 0.53)</b>



PROCESS OUTCOMES:  
FOLLOW UP AT EACH  
STEP OF THE HCV  
TREATMENT CASCADE

Characteristic	N (%)	P value	N (%)	P value	N (%)	P value
<b>Full cohort</b>	Completed treatment 796/867 = 91.8%		Assessed for SVR 678/867 = 78.2%		Cured 607/678 = 89.5%	
<b>Age</b>		<b>&lt; 0.001</b>		<b>&lt;0.001</b>		<b>0.007</b>
< 45 years	358 (87.1)		280 (68.1)		240 (85.7)	
≥ 45 years	438 (96.1)		398 (87.3)		367 (92.2)	
<b>Housing status</b>		<b>&lt; 0.001</b>		<b>&lt; 0.001</b>		<b>0.012</b>
Homeless or unstably housed	659 (90.4)		545 (74.8)		480 (88.1)	
Stably housed	137 (99.3)		133 (96.4)		127 (95.5)	
<b>Incarcerated, past year</b>		<b>0.004</b>		<b>&lt; 0.001</b>		0.335
No	410 (94.9)		351 (81.3)		319 (90.9)	
Yes	119 (89.5)		83 (62.4)		71 (85.5)	
Unknown	267 (88.4)		244 (80.8)		217 (88.9)	
<b>Heavy alcohol use, past 6 months</b>		0.411		<b>&lt;0.001</b>		0.487
No	407 (92.7)		311 (70.8)		274 (88.1)	
Yes	126 (92.7)		121 (89.0)		111 (91.7)	
Unknown	263 (90.1)		246 (84.3)		222 (90.2)	
<b>Illicit drug use, past 6 months</b>		<b>&lt; 0.001</b>		<b>&lt; 0.001</b>		<b>&lt; 0.001</b>
No	268 (96.1)		225 (80.7)		211 (93.8)	
Yes	342 (87.2)		279 (71.2)		233 (83.5)	
Unknown	186 (94.9)		174 (88.8)		163 (93.7)	
<b>Referral source</b>		<b>0.024*</b>		<b>&lt; 0.001</b>		0.095*
Internal	569 (93.4)		528 (86.7)		479 (90.7)	
Counseling & Testing	182 (87.5)		123 (59.1)		106 (86.2)	
External / self-referred	45 (90.0)		27 (54.0)		22 (81.5)	

# SUMMARY OF RESULTS

- **Primary outcome**

- Groups more likely to achieve SVR

- Individuals  $\geq 45$  years old (1.53x higher)
- Stably housed individuals (3.8x higher)
- Documented heavy alcohol use (2.2x higher)

- Groups less likely to achieve SVR

- Those with documented recent substance use were about half as likely to achieve SVR
- Individuals referred from the Counseling & Testing team (mostly residential treatment programs or street outreach)
- Individuals referred externally or self-referred

- **Secondary outcome**

- 92% of individuals completed treatment → 90% who presented for SVR were cured (mITT)
- Homelessness/unstable housing and recent substance use associated with poorer retention at every step
- Heavy alcohol use associated with improved retention at only one step (SVR assessment)

## HOUSING & SVR

- Why?
  - Competing priorities of survival, shelter, active substance use, etc.
  - High risk of theft or loss without safe medication storage
  - Retention impacted by transience: street, shelter, transitional treatment programs, etc.
- Does this mean we shouldn't treat?

## SUBSTANCE USE & SVR

- Why?
  - Competing priorities
  - High burden of homelessness
  - Retention impacted by transience: street, shelter, transitional treatment programs, etc.
    - Boston is hub for services for people from outside the area
- Should we still treat?
  - Treating people who are actively using will reduce forward transmission and support elimination goals (TasP)

# IDEAS FOR QUALITY IMPROVEMENT

## **What more is needed to improve outcomes for these cohorts?**

- The overlapping stressors of homelessness and substance use require intensive support
- Continue treating within homeless health centers while also going further into shelter and street-based spaces
- Embed HCV services in substance use services (residential programs, office-based buprenorphine treatment, methadone, etc.)
- One size does NOT fit all approach
- Housing is health care!

## CONCLUSION

- HCV treatment within a homeless health center can successfully engage, retain, and support achievement of SVR for a large proportion of homeless-experienced individuals
  - Some subpopulations are more difficult to retain
- Enhanced outreach and supports should be offered in the shorter-term
- Longer-term efforts to achieve HCV elimination should aim to address the fundamental harm of homelessness itself

## FURTHER DISCUSSION

- Limitations
  - Use of EHR and self-reported data
  - Missing indicator method used to account for unknown data
  - Possible era-effect on results, as the program grew and evolved substantially over time
  - Observational nature limits casual inference
  - Limited generalizability due to uniqueness of site and population
- Reinfection
  - Ongoing analysis on reinfection in our cohort



**THANK YOU!**

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# CITATIONS

1. Barocas JA, Beiser M, León C, Gaeta JM, O'Connell JJ, Linas BP. Experience and Outcomes of Hepatitis C Treatment in a Cohort of Homeless and Marginally Housed Adults. *JAMA Intern Med. Research Letter*. 2017.
2. Baggett TP, Hwang SW, O'Connell JJ, et al. Mortality among homeless adults in Boston: shifts in causes of death over a 15-year period. *JAMA Intern Med*. Feb 2013;173(3):189-95. doi:10.1001/jamainternmed.2013.1604
3. Beiser ME, Cardoso L, Gaeta JM, Baggett TP. Estimating the Prevalence of Advanced Fibrosis in Homeless Adults with Hepatitis C in Boston. *J Health Care Poor Underserved*. 2020;31(1):128-139. doi:10.1353/hpu.2020.0013
4. Beiser ME, Smith K, Ingemi M, Mulligan E, Baggett TP. Hepatitis C treatment outcomes among homeless-experienced individuals at a community health centre in Boston. *Int J Drug Policy*. Oct 2019;72:129-137. doi:10.1016/j.drugpo.2019.03.017
5. Beiser M, Leon C, Gaeta JM. Needs Assessment of HCV-Infected Individuals Experiencing Homelessness and Implications. *J Health Care Poor Underserved*. 2017;28(1):596-606. doi:10.1353/hpu.2017.0042
6. Bharel M, Lin WC, Zhang J, O'Connell E, Taube R, Clark RE. Health care utilization patterns of homeless individuals in Boston: preparing for Medicaid expansion under the Affordable Care Act. *Am J Public Health*. Dec 2013;103 Suppl 2:S311-7. doi:10.2105/AJPH.2013.301421
7. Corcorran MA, Tsui JJ, Scott JD, Dombrowski JC, Glick SN. Age and gender-specific hepatitis C continuum of care and predictors of direct acting antiviral treatment among persons who inject drugs in Seattle, Washington. *Drug Alcohol Depend*. 03 2021;220:108525. doi:10.1016/j.drugalcdep.2021.108525
8. Falade-Nwulia O, Sacamano P, McCormick SD, et al. Individual and network factors associated with HCV treatment uptake among people who inject drugs. *Int J Drug Policy*. 04 2020;78:102714. doi:10.1016/j.drugpo.2020.102714
9. Feld JJ, Ward JW. Key Elements on the Pathway to HCV Elimination: Lessons Learned From the AASLD HCV Special Interest Group 2020. *Hepatol Commun*. Jun 2021;5(6):911-922. doi:10.1002/hep4.1731
10. Gelberg L, Robertson MJ, Arangua L, et al. Prevalence, distribution, and correlates of hepatitis C virus infection among homeless adults in Los Angeles. *Public Health Rep*. 2012 Jul-Aug 2012;127(4):407-21.
11. Harney BL, Whitton B, Lim C, et al. Quantitative evaluation of an integrated nurse model of care providing hepatitis C treatment to people attending homeless services in Melbourne, Australia. *The International Journal of Drug Policy*. 2019;
12. Hodges J, Reyes J, Campbell J, Klein W, Wurcel A. Successful Implementation of a Shared Medical Appointment Model for Hepatitis C Treatment at a Community Health Center. *J Community Health*. Aug 2018;doi:10.1007/s10900-018-0568-z
13. Hofmeister MG, Rosenthal EM, Barker LK, et al. Estimating Prevalence of Hepatitis C Virus Infection in the United States, 2013-2016. *Hepatology*. Mar 2019;69(3):1020-1031. doi:10.1002/hep.30297
14. Noska AJ, Belperio PS, Loomis TP, O'Toole TP, Backus LI. Engagement in the Hepatitis C Care Cascade Among Homeless Veterans, 2015. *Public Health Rep*. 2017 Mar/Apr 2017;132(2):136-139. doi:10.1177/00333549166896102.
15. Read P, Gilliver R, Kearley J, et al. Treatment adherence and support for people who inject drugs taking direct-acting antiviral therapy for hepatitis C infection. *J Viral Hepat*. Nov 2019;26(11):1301-1310. doi:10.1111/jvh.13175
16. Strehlow AJ, Robertson MJ, Zerger S, et al. Hepatitis C among clients of health care for the homeless primary care clinics. *J Health Care Poor Underserved*. May 2012;23(2):811-33. doi:10.1353/hpu.2012.0047
- Valerio H, Alavi M, Silk D, et al. Progress towards elimination of hepatitis C infection among people who inject drugs in Australia: The ETHOS Engage Study. *Clin Infect Dis*. May 2020;doi:10.1093/cid/ciaa571
17. World Health Organization. Global hepatitis report 2017. <https://apps.who.int/iris/handle/10665/255016>.
18. Ziff J, Vu T, Dvir D, et al. Predictors of hepatitis C treatment outcomes in a harm reduction-focused primary care program in New York City. *Harm Reduct J*. Mar 2021;18(1):38. doi:10.1186/s12954-021-00486-4